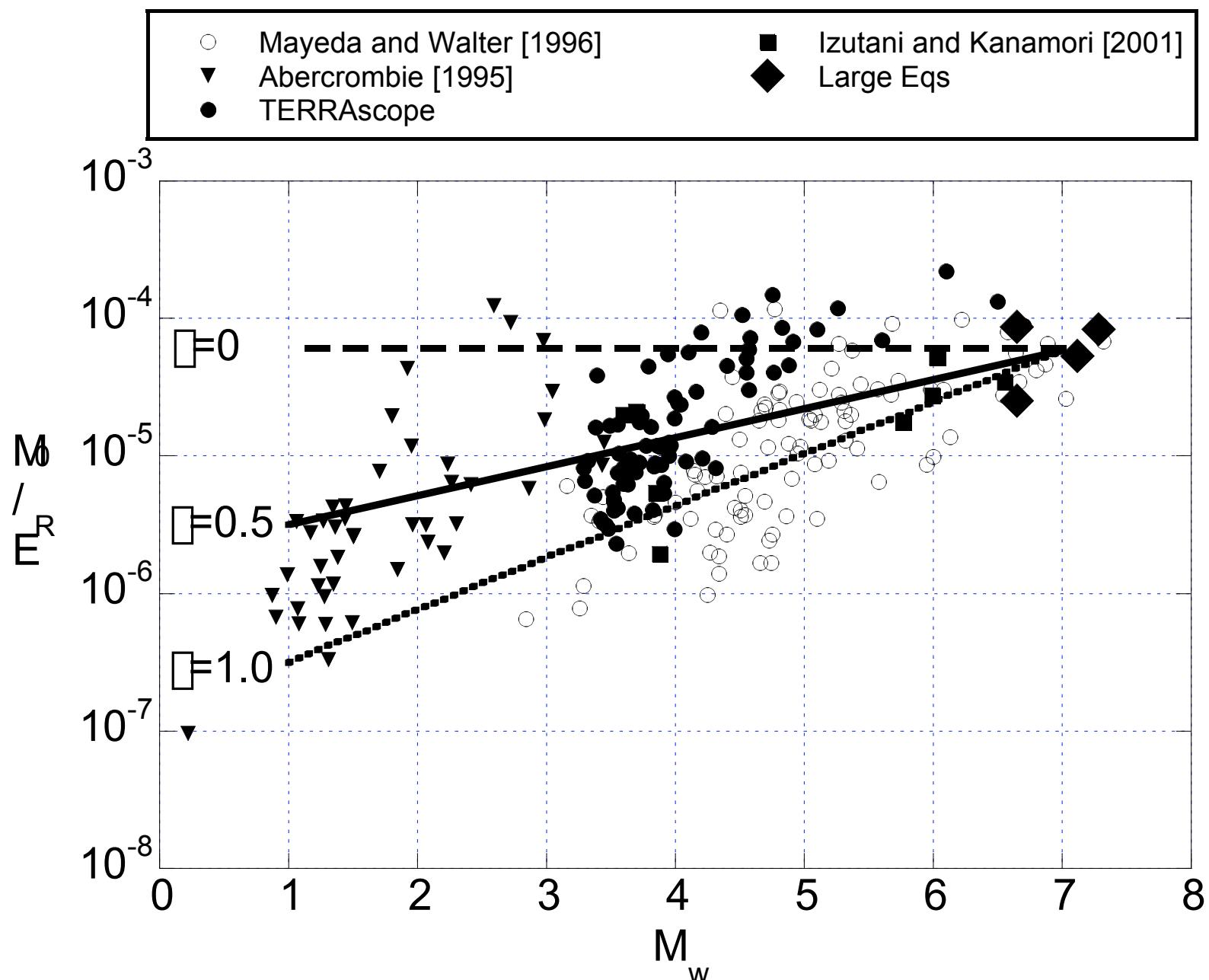


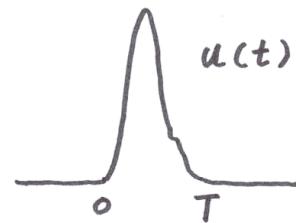
Static and Dynamic Scaling Relations for Earthquakes and Their Implications for Rupture Speed and Stress Drop

Hiroo Kanamori, Seismological Laboratory,
California Institute of Technology, Pasadena, California 91125

Luis Rivera, EOST-IPGS; Université Louis Pasteur,
5, Rue René Descartes, F67084, Strasbourg, France



Minimum E_R/M_0



$$M_0 = C_M \int_0^T u(t) dt$$

$$E_R = C_E \int_0^T \dot{u}^2(t) dt$$

Fix M_0
minimize E_R

$$J = E_R - \lambda M_0 = \int_0^T C_E \dot{u}^2(t) dt - \lambda \int_0^T C_M u(t) dt$$

$$\delta J = 0 \quad \rightarrow \quad \tilde{e}_{\min} \approx 0.87 \left(\frac{V}{\beta} \right)^3 \left(\frac{\Delta \sigma_s}{\mu} \right) = 0.87 \left(\frac{1}{\mu \beta^3} \right) (\Delta \sigma_s V^3)$$

Static Scaling Relation

$$M_0 = C_1 (\Delta \sigma_s V^3) f_0^{-3}$$

Commonly used: $M_0 \propto f_0^{-3}$

$\Delta \sigma_s V^3 = \text{const.} \rightarrow \tilde{e}_{\min}$ must be scale independent

Alternative:

$$M_0 = C_2 f_0^{-(3+\varepsilon)}, \text{ then } \tilde{e}_{\min} \propto 10^{1.5 M_w \varepsilon / (3+\varepsilon)} \quad \text{and} \quad \Delta \sigma_s (M_w) V^3 (M_w) \propto 10^{1.5 M_w \varepsilon / (3+\varepsilon)}$$

